Resumen de Conferencia en Universidad de Málaga, 27 noviembre de 2015

Mecanismos de plasticidad sináptica en sinapsis neocorticales en desarrollo

Spike timing-dependent plasticity (STDP) is a strong candidate for an N-methyl-D-aspartate (NMDA) receptor-dependent form of synaptic plasticity that could underlie the development of receptive field properties in sensory neocortices. NMDA receptors are necessary for both synaptic potentiation and depression, but the precise location of these receptors has not been established until recently. By loading MK-801 into pre- or postsynaptic neurons during paired recordings of synaptically connected layer 4 and layer 2/3 neurons in mouse barrel cortex, we found that synaptic potentiation requires postsynaptic, but not presynaptic, NMDA receptors, whereas synaptic depression requires presynaptic, but not postsynaptic, NMDA receptors. We have investigated the developmental profile of t-LTD at layer 4-to-layer 2/3 synapses of mouse barrel cortex and studied their NMDA receptor subunit dependence. Timing-dependent LTD emerged in the first postnatal week, was present during the second week and disappeared in the adult, whereas t-LTP persisted in adulthood. An antagonist at GluN2C/D subunit-containing NMDA receptors blocked t-LTD but not t-LTP. Conversely, a GluN2A subunit-preferring antagonist blocked t-LTP but not t-LTD. The GluN2C/D subunit requirement for t-LTD appears to be synapse specific, as GluN2C/D antagonists did not block t-LTD at horizontal cross-columnar layer 2/3-to-layer 2/3 synapses, which was blocked by a GluN2B antagonist instead. These results show an NMDA receptor subunit-dependent double dissociation of t-LTD and t-LTP mechanisms at layer 4-to-layer 2/3 synapses, and suggest that t-LTD is mediated by distinct molecular mechanisms at different synapses on the same postsynaptic neuron.

Publicaciones recientes relacionadas:

1. Rodríguez-Moreno, A*. and Paulsen, O. (2008). Spike timimg-dependent long-term depression requires presynaptic NMDA receptors. *Nat. Neurosci.* 11(7): 744-45. *Corresponding author.

2. Rodríguez-Moreno, A*, Banerjee, A. and Paulsen, O. (2010). Presynaptic NMDA receptors and spike timing-dependent depression at cortical synapses. *Front. Synaptic. Neurosci*. 2:18. *Corresponding author.

3. Rodríguez-Moreno A*, Kohl, M.M., Reeve, J.E., Eaton, T.R., Collins, H.A., Anderson, H.L., and Paulsen, O. (2011). Presynaptic induction and expression of timing-dependent long-term depression demonstrated by compartment-specific photorelease of a use-dependent NMDA receptor antagonist. *J. Neurosci.* 31(23):8564-9. *Corresponding author.

4. Rodríguez-Moreno, A*., Upton, A.L., Banerjee, A., González-Rueda, A., Craig, M., Paulsen, O. (2013). Presynaptic self-depression at developing neocortical synapses. *Neuron 77:35-42. Cover.* *Corresponding author.

5. Banerjee A, González-Rueda A, Sampaio-Baptista C, Paulsen O, Rodríguez-Moreno A. (2014). Distinct mechanisms of spike timing-dependent LTD at vertical and horizontal inputs onto L2/3 pyramidal neurons in Mouse barrel cortex. *Physiol. Rep.* 2(2), e00271.